DOCUMENT RESUME

ED 325 008 HE 023 925

AUTHOR Friedman, Suanne
TITLE Lack of Emphasis on Nutrition in Medical School Curriculum.
PUB DATE Jul 90
NOTE 75p.; M.S. Practicum, Nova University.
PUB TYPE Dissertations/Theses - Practicum Papers (043)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS *Curriculum Development; *Curriculum Enrichment; Demonstration Programs; Educational Needs; Health Education; Higher Education; Knowledge Level; *Medical Education; Medical Students; *Nutrition Instruction; Teaching Hospitals
IDENTIFIERS *Nutrition Education Program

ABSTRACT

The need and concern for the apparent lack of nutrition education provided in training programs for physicians was the impetus for begining a 10-session nutrition lecture series program. The program was developed and implemented in a large teaching medical center hospital and given to 16 third-year medical students. The program's purpose was to expand the nutrition education within the medical curriculum with the main focus being practical application of basic concepts. Program goals included early identification of patients at nutritional risk, improving nutritional assessment of at risk patients, increased understanding of appropriate choices of nutritional support, and heightened awareness of the role of the nutrition support service and registered dietitians. Course content included: nutritional assessment; enteral nutrition (formula choices, administration, equipment, and complications); and parenteral nutrition (guidelines for use, complications and fluid requirements). Results of a pre-test and post-test showed there was a significant improvement of nutrition knowledge of the medical students. It was concluded that expansion of nutrition education within the medical curriculum was successful. Expansion of the lecture series is being reviewed. Nineteen appendixes contain examples of various lecture series instructional, survey, and evaluation materials. (GLR)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED325008

Lack of Emphasis on Nutrition in Medical School Curriculum

by:
Suanne Friedman

A Practicum Report
Submitted to the Faculty of the Center for the Advancement of Education at Nova University in partial fulfillment of the requirements for the degree of Master of Science

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Suzanne Friedman
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

July/1990

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
X This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

HE 023 925

Table of Contents

Title Page i

Authorship Statement ii

Abstract iii

Observer's Verification iv

Chapters

I. Purpose 1

II. Research & Solution Strategy 9

III. Method 16

IV. Results 18

V. Recommendations 22

Reference List 24

Appendices

Appendix A: General Questionnaire 28
Appendix B: Patient Interviewing Questionnaire . . 29
Appendix C: Medical School Survey 30
Appendix D: Nutrition Support Evaluation . . . 31
Appendix E: Program Content Evaluation . . . 34
Appendix F: Program Proposal 35
Appendix G: Program Outline 36
Appendix H: Nutrition Lecture Series Announcement . . 37
Appendix I: NSS Case Study Schedule. 38
Appendix J: Nutritional Assessment 39
Appendix K: Enteral Nutrition/Choosing a Formula . . 44
Appendix L: Guidelines for Use of Total Parenteral Nutrition 46
Appendix M: How much nutrition does my patient need? . 49
Appendix N: Fluid Requirements 52
Appendix O: Enteral Nutrition: Administration, Equipment . 53
Appendix P: Complications of Enteral Support . . . 58
Appendix Q: Complications of Parenteral Support . . 60
Appendix R: Nutrition and Your Health 63
Appendix S: Instructors Evaluation 68

Authorship Statement

I hereby testify that this paper and the work it reports are entirely my own. Where it has been necessary to draw from the work of others, published or unpublished, I have acknowledged such work in accordance with accepted scholarly and editorial practice. I give this testimony freely, out of respect for the scholarship of other workers in the field and in the hope that my work, presented here, will earn similar respect.

Signed: Suanne Friedman

Suanne Friedman

Abstract

Lack of Emphasis on Nutrition in Medical School Curriculum
Friedman, Suanne, 1990. Practicum Report, Nova University, Center for the Advancement of Education.
Descriptors: Nutrition education / Medical students / Medical training programs / Medical education / Nutrition knowledge / Medical school curriculum / Nutrition science

The need and concern for the apparent lack of nutrition education provided in training programs for physicians is well documented in both the professional and lay literature. A ten-session nutrition lecture series program was developed and implemented in a large teaching medical center hospital to third year medical students. This program was an adjunct to a one hour lecture on Nutrition assessment - "how to do it." The purpose of this program was to expand the nutrition education within the medical curriculum with the main focus being practical application of basic concepts. Program goals included early identification of patients at nutritional risk, improving nutritional assessment of risk patients, increased understanding of appropriate choices of nutritional support and heightened awareness of the role of the nutrition support service and registered dietitians. Course content included Nutritional assessment, "how much nutrition does my patient need?;" Enteral nutrition: formula choices, administration, equipment, complications; and Parenteral nutrition: guidelines for use, complications and fluid requirements. Results of a pre-test and post-test showed there to be a significant improvement of nutrition knowledge of the medical students. It was concluded that expansion of nutrition education within the medical curriculum was successful. The possibility of expanding this lecture series to the house staff and dietetic interns is being reviewed.

Appendix J

Nova University
Center For The Advancement of Education
3301 College Avenue
Fort Lauderdale, FL 33314

Observer Verification Form

Verification of Practicum Activity

Dear Observer:

Practicum students in Nova's M.S. and Ed.S. programs are asked to provide external verification that the project activities reported in their final practicum documents took place as described. You have been designated an observer to fulfill this confirmation function by the student named below. On this sheet, then, please write a note attesting to your knowledge of the project activity described in the final practicum report to which this will be attached. (Note that you are not asked to evaluate or make judgments about the quality of the project.)

Practicum Title LACK of Emphasis on Nutrition in Medical School Curriculum

Student's Name SUZANNE FRIEDMAN RD, CNSD

Program Site Jackson Memorial Hospital Date 1/29/90

Observer's Name Patricia M. Byers, M.D. (please print-------and sign)

Observer's position Chief Nutr Sup Serv Phone # (305) 549-7039

Observer's comment on impact of the project (handwritten):

An excellent project, felt to be of tremendous value to medical students as per student comments, faculty comments + nursing observations.

Chapter I

Purpose

This hospital was recently selected by medical specialists from all over the country as one of America's top rated hospitals. Among the top twenty five selected hospitals, this hospital has many unique qualities. It was the only chosen Florida institute and the only county hospital. It is the nation's second largest acute-care hospital with the highest occupancy rate, 90%, and the largest number of admissions, 49,510 per year. As one of the largest medical centers in the county, it has made numerous medical advances. In charge of many of its departments and specialty divisions are medical experts and clinical chairmen who are internationally recognized. This is a medical center that shows steady increase in the quality of medical care.

Currently the only nutrition that is included in the medical school curriculum is diluted in a course entitled Systemic Biochemistry. This is a ten week course with a weekly discussion session given to the first year medical students during their spring semester. The students are evaluated by four interim examinations, discussion material and a final examination. However, all four of the interim examinations are combined with Physiology.

During the students' second year there is no nutrition component in the curriculum. In the third year, the students have a limited exposure to nutrition support during their trauma rotation. They are required to attend a one hour lecture on nutrition assessment - "How to do it." They are also required to complete a nutrition support case study. Each student is then individually assigned a patient for whom they must correctly complete the nutrition support case study. A nutrition support team member is assigned to assist the student in correctly completing the case study. Once completed, the students must

present the case study to the nutrition support team and the attending physician for final completion of their nutrition assignment. The students rely very much on the nutrition support team member for guidance in completing their assignment.

The nutrition support team is multidisciplinary and includes a physician director, registered dietitian, registered nurse, and registered pharmacist. This team brings together the diversity of skills and talent necessary to meet the increasingly complex and technical aspects of nutrition support. The diversity of the team allows various perspectives on the optimal care of the patient, which is its major goal. The team also plays an important role in educating other staff members about the advances and trends in state-of-the-art nutrition support.

The nutrition support dietitian is a registered and certified dietitian with clinical experience in specialized nutrition support obtained through education and experience in this field. This is currently the author's position. The role and responsibilities of this dietitian include assessing nutrition status by using laboratory data, documenting nutrition histories, identifying patients at nutritional risk and determining patient's estimated energy and nutrient needs. Other activities include monitoring and documenting the response of the patients to specialized nutrition support and facilitating both a smooth transition to an oral diet and the termination of enteral and parenteral therapies when appropriate. Through ongoing monitoring, the dietitian is responsible for reviewing the patient's status and, in consult with other team members, making appropriate changes in therapy. The dietitian also serves as the principle resource person to the other health care professionals and provides the most current information on aspects of assessment, enteral products and monitoring of nutritional support.

Within the past 25 years there has been a renewal of interest in nutrition in this country. The public's demand for nutrition information is rapidly growing. Since most individuals regard their physicians as the primary source of such information, the need to teach clinical nutrition to medical students has never been greater, as stated by Rombeau (1984) and White (1988). However, Levy (1984) claimed that nutrition education within the curricula of American medical students has a history of suffering from benign neglect.

The committee on Nutrition in Medical Education of the Food and Nutrition Board National Academy of Science has published an extensive review of nutrition education in U.S. Medical Schools as reported by White (1988). This showed that there is not enough attention or recognition given to the subject of nutrition. Most medical school offerings in the subject are inadequate to meet present and future demands of the medical profession. Nutrition education integrates many different areas of medical expertise into a unified approach to the patient. Nutrition education is not a specific discipline, but a consciousness-raising problem. Therefore, nutrition education is one of the few subjects in medical school that must be taught in all four years to be mastered properly. Schulman (1984), and Wahlqvist and Isaksson (1983), felt that clinicians today need to be much more competent in nutrition than they were a decade ago, improvement of nutrition teaching in total curriculum is needed.

During the 1960's and 1970's a number of conferences and surveys were conducted. The historic Chicopee and the Williamsberg Conference urged physicians to master the sociology as well as the science of nutrition. Other conferences that took place included the White House Conference on Food, Nutrition and Health, The Anaheim Conference, The Ten State Nutrition Survey, the first Health and Nutrition Examination Survey and the National Workshop on Nutrition Education in Health Professional Schools.

All of these conferences were held for the development of goals, strategies, and policies for implementation of nutrition education programs. Young (1984) claimed that as a result, over the past few years, surveys were conducted by Cyborski and the American Medical Association. Hoting and Littlefield (1985) summarized that these surveys indicated that 70 percent of medical schools have an elective course in nutrition, while only 25 percent have a required course in nutrition.

The Southeastern Regional Medical Nutrition Education Network (SERMEN) was developed in an effort to enhance nutrition education in the southeastern medical schools. SERMEN evaluated the nutritional knowledge and attitudes of medical students. The results of this study and previous SERMEN studies revealed that 85 percent of the senior medical students expressed dissatisfaction with the quantity of their medical-nutrition education and 60 percent expressed dissatisfaction with the quality of their nutrition instruction, as summarized by Weinsier (1988). This suggests that the students recognize the importance of nutrition and wish to receive more training. It has been determined that nutrition knowledge of medical students, as measured on a standardized examination, is related to the quantity and quality of nutrition courses and is increased by a separately indentifiable course in nutrition.

A general questionnaire (Appendix A: p.28) and a patient interviewing questionnaire (Appendix B: p.29) were distributed to the third year medical students. Results of the general questionnaire revealed that during the students' premedical training, none of the students had taken a required nutrition course, only six percent (one student) had electively taken a nutrition course, and 34 percent (five students) had not had any nutrition education at all, 60 percent (nine students) had nutrition as a component of another course in their premedical school training with this course being less than five hours.

However, all of the students expressed a positive attitude towards participating in an elective nutrition course if it were available. This attitude was further supported by the overwhelming response of the students' feelings that a good background in nutrition would be very important to their career goals, along with nutrition having a very important impact on the overall care of the patient.

The patient interviewing questionnaire showed that the one question that was routinely asked by 100 percent of the students when they conduct a patient interview was in reference to whether or not the patient has had any recent weight change. Eighty percent (12 students) further questioned weight changes to both the quantity and time period of the change. Forty seven percent (11 questions) were asked by greater than 80 percent of the students. These questions were concerning the patient's appetite, the presence of certain gastrointestinal conditions that had changed the patient's appetite, ie., nausea, vomiting, diarrhea, and constipation. Other questions were concerning the patient's diet including type of diet and purpose for the diet, but the students did not routinely inquire as to the length of time the patient was on the diet, or if the patient followed the diet and if not, why not. Twenty two percent (five questions) were asked by greater than 40% of the students concerning the patients height, current weight, and physical conditions that had changed the patients appetite, ie., anorexia, taste alterations, difficulty chewing and/or swallowing and quick satiety. Overall only 28 percent (six questions) were routinely asked by greater than 80 percent of the students.

A survey (Appendix C: p.30) to Florida teaching medical centers was conducted by the author. The current nutrition education at the surveyed centers was compliant with the literature; there is no specific program for curriculum development in nutrition education. The nutrition course at each medical center differed in the following ways: the

total course hours, the course being either elective or required, the course being a separate course or a component of another course, and the number of years a nutrition course or component of nutrition had been a part of the medical curriculum.

Gautreau and Monsen (1979) claimed that it is imperative that medical schools provide opportunities for their students to learn the fundamentals of nutrition, since the deficiency in nutrition education that exists when the physician leaves medical school is seldom overcome in practice. By providing this opportunity of integrating nutrition knowledge and its application into the medical curricula, the medical students will be able to deliver an improved quality of patient health care.

Young (1984) proposed that this lack of emphasis on nutrition is also reflected on the National Board Examination where there is only a three percent frequency of nutrition related questions. Shils (1984) reported that since clinical nutrition is a relatively new area, it has not yet been recognized as a medical subspecialty. Such recognition would have a great impact on improving nutrition education in the medical schools as it would increase the number of qualified physician-educators and faculty members would be better educated. Currently many of the faculty teaching nutrition have never been firmly grounded in basic nutrition except for some exposure to clinical nutrition, and this would also allow for the development of specific training programms with educational criteria. Rombeau (1984) felt that specific training programs would avoid the problem of teaching nutrition that is partly related to the variability of medical schools in their goals, objectives, curricular flexibility and expertise among the faculties.

Young (1984) and Levy, Tischfield and Marse (1984) proposed that in order to begin to correct this deficiency, the administration of the medical school needs to establish nutrition as a discipline on the medical school and commit to a budget.

Adequate funding is essential for the development and maintenance of a nutrition program that includes curriculum development, nutrition faculty members, training programs, nutrition support teams, nutrition laboratory support, nutrition counseling, and nutrition research. The explosion of knowledge in many medical disciplines has created fierce competition for curricular time. Fitting a new course like clinical nutrition into an already over-crowded curriculum oftentimes results in it being assigned a low priority. Feldman (1984) stated that there is little awareness of how lack of attention to nutritional factors increases the cost of medical care, prolonged hospitalization, and increases morbidity and mortality. A nutrition coordinating committee must be formed to develop a nutrition curriculum. Both Shulman (1984) and Phillips (1971) felt that nutrition must be properly marketed by the nutrition committee to convince the curriculum committee of the importance of incorporating a clinical nutrition course into the medical curriculum with sufficient time allotment, since the dietitian can not alone improve nutrition teaching of medical students.

Objectives developed to assess effectiveness of the nutrition lecture series program were:

Objective 1: Having participated in a nutrition education component, greater than 80 percent of the students will understand greater than 80% of the information as measured by a post test (Appendix D: p. 31).

Objective 2: Having completed a nutrition education component, greater than 80% of the students will understand greater than 80% of the information as measured by a case study.

Objective 3: Effectiveness of program content documented by greater than 80% of the students as measured by a program content evaluation (Appendix E: p. 34).

Objective 4: 100% attendance at all 10 sessions by greater than 80% of the students as measured by maintenance of an attendance log.

While not measurable due to time factors, additional outcomes were expected relative to skills associated with provision of proper nutritional support for optimal patient care: 1) early identification of patients at nutritional risk; 2) improved nutritional assessment of risk patients; 3) increased understanding of appropriate choices of nutritional support; 4) decreased nutritional risk patients with inadequate nutritional support; 5) heightened awareness of the role of the nutrition support service and registered dietitians.

Chapter II

Research and Solution Strategy

Nutrition should be one of the most important subjects taught in medical school, yet during the past several decades education in nutrition in medical schools has been inadequate. There is a real urgency for improving nutrition education for medical students, and even more directly there is tremendous urgency to improve nutritional management of hospital patients as described by Kuperman (1984). Preventive medicine is an area of great challenge and opportunities in the United States. Medical students need to know the opportunities and limitations of nutrition in this area, with realistic notions of what can and cannot be done. Exaggerated views of what nutrition can do has lead to faddism, self-medicaion and proliferation of the widest variety of diets to cure almost every illness.

Dr. Levenson (1984) summarized that nutrition education integrates many different areas of medical expertise into a unified approach to the patient. Nutrition education is not a specific discipline, but a consciousness-raising program. It must teach an approach to a variety of patients from seriously ill patients who require parenteral nutrition to mildly hypertensive patients who may need only counseling about salt intake.

Phillips (1971) Gautreau and Monsen (1970) and Kjellman (1974) report that the nutrition knowledge of medical students is poor, implying that formal training in nutrition in many medical schools is inadequate. The need for nutrition education as part of a training program for physicians is widely recognized according to Walsh (1987). Young (1984) declared we are now beginning to realize how essential nutrition is to medical education. If physicians received appropriate training in nutrition, they would not only be a powerful force in providing accurate nutrition information, but they could also positively

affect the delivery of medical care to their patients and ultimately, the long term health and well being of the public.

According to Feldman (1984) minimum information to be learned must include basic nutrition, nutrition through the life cycle, disorders of undernutrition and nutrition in special clinical situations. A survey conducted by Gautreau annd Monsen (1979) revealed similar data. It is felt that these concepts would serve as a background for all nutritional knowledge and would be especially useful in clinical practice. However, Lopez-S (1984) felt training programs sould not merely reveiw nutrition science, but be eminently clinical. This is also supported by Wahlqvist and Isaksson (1983) who felt training should include both bedside and laboratory work as well as exposure to related research. Shils (1984) declared that clinical nutrition must become a subspecialty for there to be developement of specific educational criteria for nutritional training programs. Kesner (1984) claimed that only after the educational components are all in place and can reinforce each other will students begin to feel well trained in nutrition after four years in medical school.

Levy (1984) proposed that goals of an instructional program should have the following objectives; students will be able to take a patient's diet history including a one day, three day, prospective and recall history. Students will be able to perform a physical exam. Students will be able to take a patient's anthropometric measurements including height, weight, skinfold thickness and arm circumference. Students will be able to order and interpret appropriate laboratory studies, including blood chemistries, nitrogen balance and creatinine levels. Students will be able to make a nutritional diagnosis on a patient, including calculation of the patient's nutritional needs through the use of the Recommended Dietary Allowance (RDA). Students will be able to formulate a problem list which should include all abnormal findings. Young (1984) proposed that an important

long-term goal is to effectively incorporate nutrition assessment and management as a routine aspect of patient care.

Rombeau (1984) advocated four steps in the development of an integrated nutrition education curriculum: documentation of student interest and faculty expertise; review of the current curriculum for the inclusion of nutrition related topics; formulation of goals, content, and process objectives; and recommendation for specific options for content. This integrated approach advocated by Rombeau describes nutrition education being taught in both the preclinical and the clinical years. Education in the preclinical years includes basic principles such as digestion, absorption, metabolism, nutritional requirements for normal growth and development, undernutrition, overnutrition, and diseases of nutrition. During the clinical years, the medical curriculum can focus on clinical aspects of diseases and nutrition, along with dietary management of metabolic and other diseases. Since access to the students was not possible during the preclinical years, the author will implement the nutrition education series during one of the clinical years. This timing of education is consistant with the other two Florida medical centers, and is still early in their careers as supported by the literature.

Lowell and Shulman (1984) felt that a required course in the first or second year is the most efficient and effective way to teach nutrition to medical students. By exposing students to nutrition early, they may use it for themselves and later for their patients. However, Winick (1984) felt it is important that nutrition be taught when it can be most clinically relevant to the student. From a student's perspective, Shulman (1984) suggested that nutrition be taught in all four years to be mastered properly.

Teaching methods vary throughout the literature, including noon conferences, grand rounds, chart audits, slide and video presentations, special diet luncheons, case

studies, and following inpatient dietitians through their routine for a day. Not all of these teaching methods work in all places due to institutional limitations. Karp (1984) suggested that class learning unsupplemented by role models and clinical experience tends to be lost. He believed that behavioral objectives are particularly valuable during the clinical years. This helps to delineate for the student clearly defined ways to incorporate nutrition into patient care and aid in the assimmilation of nutrition knowledge into the clinical setting. Nutrition must be properly marketed by administration and professors and presented to the medical students as an integral part of their education. Karp et al (1984) believed in developing an attitude that nutrition is an accepted part of medicine. This is also supported by Feldman (1984) in that a change in attitude must occur so that nutrition education is given a chance. The administration, hospital, medical school board, department chairmen, students and patients must be cultivated. Until the curriculum committee adds a basic or clinical nutrition course into the curriculum, the current curriculum must be infiltrated with nutrition education. Providing lectures, handout material and references will enhance the students interest. Elective and research projects should be offered at all levels for interested students. Distribution of nutrition newsletters with informative publications can exemplify to medical students, house officers, faculty members and administrators how important nutrition is.

A study of United States medical schools was conducted by the American Medical Association on the nutrition education of their medical curriculum. The following results were reported by Cyborski (1977): 95 percent incorporated nutrition into another course; 80 percent offered an opportunity for students to do nutrition research; 70 percent offered nutrition as an elective course; 19 percent offered nutrition as a required course, 31 percent offered postgraduate or continuing education studies in nutrition and 28 percent

offered a clerkship in nutrition. A premedical alternative proposed by Guthrie (1979) and supported by Young (1984) encourages nutrition during the premedical years. The argument of ineffeciency for those who do not go on to medical school can be challenged, as some nutrition knowledge would serve useful purpose regardless. Many advantages support this concept since there is usually moire flexibility in schedules during these four years. Phillips (1971) also supports nutrition education during premedical years. Since many of these courses would be taken with dietetic students, the medical student would gain an appreciation and respect for the expertise which other qualified professionals can bring to the medical team. Therefore, incorporating basic nutrition in a premedical program is a viable alternative to the dilemma of adding one more professional course in an already overcrowded medical curriculum. Kesner (1984) further supported this idea, as he claimed it is nearly impossible to fit a new course into the already crowded curriculum. This type of alternative, however, should not be a substitute to the clinical approach in medical school, but provide a foundation on which it can be built.

LeGardeur, Ferris, Lopez-S (1987) discussed how a compulsory clinical nutrition course has been included in the curriculum of fourth-year medical students at Louisiana State University Medical School since 1982. As a result of this course the senior medical students have come to realize the significant role of the dietitian in the nutrition care of the patient. It also allowed dietitians to become aware of the increased interest of young physicians in the importance of nutrition in the care of patients. More physicians are willing to learn about nutrition because it is important for their medical competence and ultimately the care of their patients. Kensner (1984) claimed by capturing them early in their careers, they are sensitized to the importance of nutrition as something relevant to

their medical education.

Dr. Levenson (1984) stated that the developement of a nutrition curriculum within a medical school requires a curriculum committee with an interest in seeing that nutrition is taught. According to Rombeau (1984), goals should be established by the nutrition committee as follows: to promote knowledge of and awareness of nutrition in all areas of medicine; to teach basic and applied nutrition; to integrate nutrition in overall health care training; and to obtain university commitment to a comprehensive nutrition education program. Dr. Iber (1984) claimed that the involvement of as many as possible interested faculty members from different departments, ie. dietitians, pharmacy, and nutrition support teams can enhance more changes on the overall nutrition education curriculum for medical students than working through committee structures. Kuperman (1984) supported the idea of identifying faculty members with an interest in nutrition from the viewpoint of education, service, and research and getting them together in some kind of task force with the aim of gaining support from the dean's office and the nutrition committee. Administration must commit to a budget and establish some administrative entity with nutrition in its name. Feldman (1984) suggested that it is best to have the program administratively responsible directly to the dean. Recognition and support of both administration and faculty is absolutely crucial for enhancing a successful program. It is essential to make the program required. As Deen (1984) stated, a required course addresses minimum competencies that someone must define as absolutely necessary for all physicians and that an elective nutrition course cannot meet that need. The nutrition lecture series taught by the author was indeed a requirement. Levenson (1984) felt that the most critical thing to foster nutrition education is to create an atmosphere in the hospital in which a continuous awareness, concern and study of the metabolic and

nutritional problems of patients is a central part.

However, a number of limitations have been identified throughout the literature in meeting the challenges of incorporating clinical nutrition educations into the medical curricula. Shils (1984) cited that many of the teachers in nutrition have only had some exposure to clinical nutrition but not to the basic groundwork. There is a need to identify nutritiion competencies that physicians should have. A lack of such qualified faculty members is one factor that has curtailed progress in establishing strong nutritional programs in medical education. Leadership is needed to develop a viable clinical nutrition program, and this leadership will require some degree of authority, claimed Young (1984). Much of the nutrition education in medical schools is presented in as many as 30 different courses such as metabolism, infectious disease, physiology, and pathology with the most frequent being biochemistry. Since it is taught without a nutritional point of view, the nutritional implications are often lacking. Because of the lack of emphasis on nutrition, the integration of the material needed to aproach a nutritional problem does not occur effectively.

Chapter III

Method

The sixteen third year medical students that were assigned their trauma rotation were the participants in this nutrition support lecture series. The proposed program was approved by the trauma faculty staff of the school of medicine (Appendix F: p.35). The scheduled program included an introductory class during the first day of the students' orientation to the trauma service. The rest of the schedule included classes on Monday, Tuesday and Wednesday from 8:00 AM to 8:30 AM. The classes continued weekly for three weeks. The author, a registered dietitian, certified in nutrition support, was the instructor. The sessions were conducted in the trauma conference room. The room had a blackboard, a screen for slides and a conference table for note-taking. A light breakfast was served.

Students were asked to sign in on the attendance log at each session. For session 1, a program outline (Appendix G: p. 36) and a nutrition lecture series announcement (Appendix H: p. 37) and a nutrition support case study student schedule (Appendix I) were distributed and reviewed. A general questionnaire (Appendix A), a patient interviewing questionnaire (Appendix B), and a nutrition support evaluation (Appendix D) were also distributed. The students completed the questionnaire and the surveys, which were collected by the instructor at the end of the first session.

Mid-implementation evaluation was done informally by the author. Evaluation of attendance was closely monitored since attendance was essential for adequate comprehension of the lecture series. Acceptable excuses for missing no more than two sessions were emergency room or operating room call. The students' level of

participation throughout the lecture series was also monitored and the session was modified as necessary to better meet the students learning needs.

Sessions 2, 4, and 7; *Nutrition Assessment, Enteral Nutrition: Decision process in choosing a formula*, and *guidelines for the use of total parenteral nutrition* (Appendices J: p. 39, K: p. 44, and L: p. 46) were taught in a lecture-discussion format. Sessions 3 and 9; *How much nutrition does my patient need?* and *Fluid requirements* (Appendices M: p. 49 and N: p. 52) were also taught in a lecture-discussion format with blackboard illustrations and slides. Session 5; *Enteral Nutrition: administration and equipment* was presented in a lecture-discussion format with the addition of slides, (Appendix O: p. 53).

This session was also complimented by a sales representative who presented a demonstration of the equipment and it's use. Session 6 and 8; *Complications of Enteral Support* and *Complications of Parenteral Support* (Appendices P: p. 58, and Q: p. 60) was not presented in a lecture format because the classroom was not available. However, the lecture material was still distributed for the students' information. The nutrition support evaluation (post test), instructors evaluation, and program content evaluation (Appendices D, S: p. 68, and E) were distributed. The students completed the survey and the evaluations. The instructor collected these at the close of the final session. Comments and recommendations for improvement of the lecture series were encouraged.

Chapter IV

Results

Objective 1 stated that ≥ 80 percent or more of the students (16) would attend all ten class sessions. This objective was met with 100 percent attendance at eight of the sessions and 94 percent at the other two sessions. One hundred percent attendance seems a realistic performance objective, since the sessions were required as a component of the students assignment of their trauma rotation.

Objective 2 stated that ≥ 80 percent of the students would understand the lessons measured by a grade average of ≥ 80 percent on a cognative post test. Table 1 shows that only 11 students, or 69 percent, met the requirements of objective 2. These results are probably related to the lack of premedical and preclinical nutrition education. It is not the behavioral objective that needs revision, but rather more in-depth assessment of the students nutrition education level and provision of appropriately matched sessions.

Comprehension of lessons by ≥ 80 percent of the students as measured by a grade average of ≥ 80 percent for the case study consult was objective 3. Table 1 shows that 14 students, or 87 percent met the requirements of objective 3.

Objective 4 stated that ≥ 80 percent of the students would rate the instructor performance as effective. The evaluation tool included eight instructor performance criteria rated on a scale of one to five. An instructor effectiveness rating of good and excellent was documented by 94 percent of the students thereby meeting objective 4. Table 2 delineates the students' responses by individual performance criteria.

Table 1

Results of students grade average for nutrition support evaluation and case study

*Score	0%	≥50%	≥60%	≥70%	≥80%	≥90%	≥100%
Post test	0	0	1	4	6	5	0
Case study	0	0	0	2	9	5	0

**Score	0%	≥50%	≥60%	≥70%	≥80%	≥90%	≥100%
Post test	0	0	6.2	25	37.5	31.3	0
Case study	0	0	0	12.5	56.3	31.2	0

Total number of students = 16
* Number of students who scored at each grade percentile
** Percentage of students who scored at each grade percentile

Table 2
Results of Instructors Evaluation

Performance Criteria*	**1**	**2**	**3**	**4**	**5**
Knowledge of subject matter	0	0	1	1	14
Interest and enthusiasm	0	0	0	4	12
Confidentiality	0	0	0	5	11
Managed class time effectively	0	0	1	5	10
Information presented clearly and in an organized manner	0	0	0	4	12
Handouts effective and easily read	0	0	0	1	15
Stimulated thought and discussion	0	0	4	7	5
Learning activities related to subject matter	0	0	2	4	10

Total respondents = 16; Total responses = 128
*1 (poor); 2 (fair); 3 (average); 4 (good); 5 (excellent)

Objective 5 indicated that ≥ 80 percent of the students would rate the program content as effective. On a scale of one to five, 88 percent of the students rated the degree of effectiveness of the course content as good (4) and/or excellent (5). Individual student responses for each session subject are described in Table 3. The predicted outcome was met with a margin of 8 percent. Therefore, the program content met the needs of the students with no outside classwork required. Additional written, anonymous comments were solicited at the last session because of the potential value to future lecture series planning. Many students correlated their enjoyment of the sessions with the instructor's competence and enthusiasm. One hundred percent of the students responded positively towards taking another class taught by the instructor. Some of the students felt the timing of the sessions would have been better if each session had started fifteen to thirty minutes later allowing for the students to finish from morning rounds. Another student suggested the lecture sessions to be included on their specialty rotation since time is so limited on the trauma rotation. The handout material was referred to as being "excellent," "key," and "highly applicable." One student felt the sessions were well presented, but too many for the subject matter, suggesting seven sessions instead of ten. Breakfast was offered as an incentive by the author for improving attendance and was greatly appreciated by most of the students.

Table 3
Results of Program Content Evaluation

Sessions	1	2	3	4	5
Nutrition Assessment	0	1	0	3	12
Method for Estimating Caloric Needs	0	0	0	10	6
Enteral Feeding Equipment	0	1	4	6	5
Fluid Requirements	0	0	3	7	6
Complications of Enteral Feedings	0	0	1	8	7
Choosing a Formula	0	2	1	5	8
Guidelines for Total Parenteral Nutrition	0	0	2	6	8
Complications of Total Parenteral Nutrition	0	0	2	6	8

Total respondents = 16; Total responses = 144
*1 (poor); 2 (fair); 3 (average); 4 (good); 5 (excellent)

Chapter V

Recommendations

Nutrition education needs to become an essential component at all levels of medical education. This should be done during medical school by incorporating a nutrition program into both the basic sciences and the clinical curricula. Courses specifically focused on nutrition should be required rather than strongly recommended as they are currently. By requiring a course in basic nutrition, it would encompass both biochemical and applied concepts. Although attendance was not a problem during this lecture series, interest and attention were. This author feels that until a nutrition program is an incorporated, required component of the medical curriculum, lack of motivation, interest and importance will always be a problem on the students' part.

The Committee on Nutrition in Medical Education (1985) feels that attractive basic science and clinical electives in nutrition should be developed so that students would have an option to pursue areas of special interest in greater depth, once having completed a basic nutrition course. Nestle (1982) describes that to make a successful change of incorporating nutrition into the medical curriculum, nutrition education programs must be tailored to fit the faculty and resources of the individual medical school with full utilization of existing educational resources. There would not only be added diversity to the nutrition education program, but it would also be a very cost-effective way for top-level dietetic professionals to share their expertise and knowledge of nutrition. Phillip (1971) states that physicians need to be made more aware of the help they can obtain from the registered dietitian in making appropriate decisions regarding the needs of their patients in the area of nutrition and diet therapy. This need could be rectified with effective nutrition education programs included in medical curricula. Yount (1984) proposes that in the development

of nutrition education programs, the greatest need to be identified is that of a continued move towards a stronger scientific basis for the efficacy of nutritional assessment and intervention. Scientific studies are also needed to document the cost/benefit ration for nutrition support. Once this occurs, the challenge of incorporating adequate nutrition education within the medical curricula should be minimized. With appropriate training in nutrition, the medical students could help provide accurate information and could more appropriately and effectively utilize nutrition resources in their communities to maintain and/or improve the nutrition status and, ultimately, the health of the public.

Reference List

Committee on Nutrition in Medical Education, Food and Nutrition Board, National Research Council: Nutrition Education in U.S. Medical Schools. Washington, DC: National Academy Press, 1985.

Cyborski, C.K. "Nutrition Content in Medical Curricula." Journal of Nutrition Education. September, 1977, pp. 17-19.

Deen, D. "Bridging the Gap: Nutrition Teaching in Introduction to Medicine and Physical Diagnosis Courses." Bulletin of New York Academy of Medicine. July-August, 1984, pp. 649-652.

Feldman, E.B. "Specific Goals for Nutrition Teaching, "If I Had it My Way..." Bulletin of New York Academy of Medicine, July-August, 1984, pp. 572-584.

Gautreau, S., Monsen, E.R. "Priorities of Nutritional Concepts Assigned by Health Professionals and Students." Journal of Medical Education. August, 1979, pp. 607-612.

Guthrie, H.A., Teply, C.L. "Nutrition in Medical Education - A Premedical Alternative." The American Journal of Clinical Nutrition. August 1979, pp. 1557-1558.

Hoting, H., Littlefield, J.H. "Improving Nutrition Components in Medical and Dental School Curriculums." Journal of the American Dietetic Association. April, 1985, pp. 479-480.

Iber, F.L., "Nutrition Education for Medical Students at the University of Maryland." Bulletin of New York Academy of Medicine. July-August, 1984, pp. 627-631.

Karp, R. "A Methodology for Nutrition Curriculum Evaluation." Bulletin of New York Academy of Medicine. July-August, 1984, pp. 585-590.

Karp, R., Stevenson, N., Kuperman, A., Gebhardt, C. "Evaluation of the Quantity of Nutrition Teaching in the Curriculum." Bulletin of New York Academy of Medicine. July-August, 1984, pp. 591-601.

Kesner, L. "Nutrition Teaching at the Basic Science Level." Bulletin of New York Academy of Medicine. July-August, 1984, pp. 642-652.

Kjellman, M., Larsson, Y., Ludvigsson, J. "Place of Nutrition in Medical Education." British Journal of Medical Education. August, 1974, pp. 117-120.

Kuperman, A. et al. "Requirements for an Effective Nutrition Teaching Program in Medical Schools: Essential Personnel and Medical Center Resources. Bulletin of New York Academy of Medicine. July-August, 1984, pp. 675-686.

LeGardeur, B.Y., Farris, R.P., Lopez-S, A. "Educational Laboratory Component of a Clinical Nutrition Course for Medical Students." Journal of the American Dietetic Association. February, 1987, pp. 214-216.

Levenson, S. et al. "Achieving Clinical Integration of Nutrition Teaching Goals." Bulletin of New York Academy of Medicine. July-August, 1984, pp. 653-689.

Levy, M., Tischfield, J.A., Marse, J.A. "The Development for a Nutrition Teaching Program." Bulletin of New York Academy of Medicine. July-August, 1984, pp. 564-572.

Lopez-S, A. "Clinical Nutrition Courses at Louisiana State University School of Medicine in New Orleans." Bulletin of New York Academy of Medicine. July-August, 1984, pp. 633-638.

Lowell, B.C. "Data on Nutrition Courses and Electives from the Regional Nutrition Centers." Bulletin of New York Academy of Medicine. July-August, 1984, pp. 613-616.

Lowell, B.C., Shulman, A.B. "The Value of Discrete Nutrition Courses." Bulletin of New York Academy of Medicine. July-August, 1984, pp. 619-626.

Nestle, M. "Nutrition Instruction for Health Professionals, Students and Practitioners: Strategies for the 1980s." Journal of Parenteral and Enteral Nutrition. June-July, 1982, pp. 191-193.

Phillips, M.B. "The Nutrition Knowledge of Medical Students." Journal of Medical Education. January, 1971,, pp. 86-90.

Rombeau, J.L. "An Integrated Approach for Nutrition Teaching in the Medical Curriculum." Bulletin of New York Academy of Medicine. July-August, 1984, pp. 602-609.

Shils, M.E. "Summary of Regional Nutrition Center Activities." Bulletin of New York Academy of Medicine July-August, 1984, pp. 558-563.

Shulman, L.P. "Nutrition Teaching in Medical Schools: The Student Perspective.: Bulletin of New York Academy of Medicine July-August, 1984, pp. 617-618.

Wahqvist, M.L., Isaksson, B. "Training in Clinical Nutrition: Undergraduate and Postgraduate." The Lancet. December 3, 1983, pp. 1295-1297.

Walsh, J.H., Dappen, A., Gessert, C. "Factors Affecting Nutrition Training in Four Family Practice Residencies." Journal of the American Dietetic Association. November, 1987, pp. 1558-1560.

Weinsier, R.L., et al. "Cross-sectional Study of Nutrition Knowledge and Attitudes of Medical Students at Three Points in Their Medical Training at 11 Southeastern Medical Schools." American Journal of Clinical Nutrition. July, 1988, pp. 1-6.

White, J.V. The Role of Nutrition in Medical Education. Food and Nutrition News, National Live Stock and Meat Board, Research/Nutrition Information Department, Vol. 60, No. 2, March/April, 1988.

Winick, M. "Discrete Nutrition Courses vs. The Integrated Approach." Bulletin of New York Academy of Medicine. July-August, 1984, pp. 610-612.

Young, E.A. "Trends in Clinical Nutrition Education." Bulletin of New York Academy of Medicine. July-August, 1984, pp. 542-557.

Appendices A - S

Appendix A

General Questionnaire

Name _____
Date _____

Please Select One:

1. During your premedical school training, you

   A. have electively taken a nutrition course.
   B. have taken a required nutrition course.
   C. have had nutrition as a component of another course, ie. biochemistry, etc.
   D. have not had any nutrition education.

1a. If you have had a nutrition course, how many hours was this course?

   A. Less than five hours
   B. Five to ten hours
   C. Greater than ten hours

2. If a nutrition course was available during medical school as an elective, do you feel that you

   A. definitely would take a course in nutrition.
   B. may take a course in nutrition.
   C. would not take a course in nutrition.

3. How important do you think a good background in nutrition will be to your career goals?

   A. Very important
   B. Not at all important
   C. Do not know

4. How important do you feel nutrition impacts on the overall care of a patient?

   A. Very important
   B. Of some importance
   C. Not important
   D. Do not know

Appendix B

Patient Interviewing Questionnaire

Please check any and/or all of the questions you routinely ask your patient:

1. How much the patient weighs currently

2. What is the patient's normal or usual weight

3. Has the patient had any recent weight change
3a. If so, during what period of time

4. How tall is the patient

5. How is the patients appetite

6. Has the patient had any changes in appetite due to any of the following conditions:

   A. Anorexia
   B. Quick satiety
   C. Taste alterations
   D. Difficulty chewing and/or swallowing
   E. Nausea
   F. Vomiting
   G. Diarrhea
   H. Constipation

7. How long has each of the above been present

8. Has the patient been on any special type of diet

9. If yes, what type

10. For what time period

11. Why are they on this diet

12. Do they follow the diet

13. If not, why not

Appendix C

Medical School Survey

I am a Registered Dietitian on a nutrition support team in a large teaching hospital. I hope that you can assist me in obtaining information. I am currently working on my thesis for my Masters. My thesis is entitled *Lack of Nutrition Emphasis in the Medical Curriculum.* I understand you are the Professor for the nutrition course taught in your medical curriculum. I would greatly appreciate any information on your nutrition course, ie, course outline, syllabus, handout materials, etc., so that I can better develop a lecture series to pilot with our students.

If possible, I will also appreciate your input on the following questions:

1. Number of hours of the course(s) _____
2. In what year is the nutrition course offered? _____
3. Is the course an elective or required course? _____
4. What is the title of the course(s)? _____
5. Is the course combined with another course? _____
   If yes, what is the name of the course? _____
6. How many years has the nutrition course been a formal part of the medical curriculum? _____

I greatly appreciate any and all information you are able to share with me. My preferred mailing address is: 3930 SW 58th Terrace, Davie, Florida 33314.

Sincerely,

_____
Sueanne Friedman, RD, CNSD

Appendix D

Nutritional Support Evaluation

Please circle the most appropriate answer to each statement or question.

1. An initial screen should be done within the first _____ hours of admission to identify existing or potential malnutrition.
   a. 12 hours
   b. 24 hours
   c. 72 hours
   d. 96 hours

2. Which one of the following is an important component of a comprehensive nutritional assessment?
   a. Physical exam
   b. Surgical history
   c. Social history
   d. All of the above

3. If a patient presents with chronic weight loss associated with a relatively long inadequate dietary intake, preserved visceral protein levels with wasted adipose and muscle tissue, this patient would be diagnosed with what type of malnutrition?
   a. Kwashiorkor
   b. Marasmus
   c. Kwashiorkor-Marasmus mix

4. Complications caused by overzealous feedings can include:
   a. Excessive CO_2 production
   b. Hepatic complications
   c. Pulmonary edema
   d. All of the above

5. When evaluating weight change, over a 6 month period, what percent weight change is considered to be a severe weight loss?
   a. 2%
   b. 5%
   c. 7.5%
   d. 10%

6. The nitrogen balance for an anabolic patient should be
   a. Positive
   b. Negative

7. What is the desired calorie-to-nitrogen ratio for a moderate to severely stressed patient?
   a. 300:1
   b. 200:1
   c. 100:1
   d. 80:1

8. What diameter of a feeding tube does a french unit measure refer to?
   a. Inside
   b. Outside

9. T F Nasoduodenal or nasojejunal feeding tubes are preferred over nasogastric tubes because they reduce the risk of aspiration.

10. T F Continuous administration of formula by tube feeding is preferred over intermittent administration for an ambulatory patient, since this gives the patient more freedom of movement.

11. T F The more nutrient dense a formula is, ie. 2cal/cc vs. 1cal/cc, the greater the percent of free water in the formula.

12. Which GI disturbance is the most commonly seen with tube feeding administration?
   a. Nausea
   b. Vomiting
   c. Diarrhea
   d. Malabsorption

13. Which is the most common metabolic complication with tube feeding administration?
   a. Hyperglycemia
   b. Hyperkalemia
   c. Hypophosphatemia
   d. Hypoglycemia

14. In a patient with a working GI tract, the preferred route of nutritional support is
   a. enteral.
   b. parenteral.

15. In choosing a formula for a patient who has limited digestion and absorption capabilities, the following type of formula that would be best would be:
   a. Milk-based
   b. High residue formula
   c. Elemental formula
   d. None of the above

16. The optimal time to check a triglyceride level on a patient receiving daily lipids is:
    a. during lipid infusion.
    b. one-two hours post lipid infusion.
    c. eight-ten hours post lipid infusion.
    d. any time.

17. In a respiratory failure patient who is ventilatory dependent, what is the most preferred combination of substrates for a TPN solution?
    a. Glucose & protein
    b. Glucose & protein & lipids
    c. Lipids & protein
    d. Glucose & lipids

18. TPN should be used as part of routine care in all **except** which one of the following clinical settings?
    a. Massive small bowel resection
    b. Radiation enteritis
    c. A patient with minimal stress and trauma, who is well nourished with expected use of their GI tract within 10 days.
    d. Patient with severe diarrhea

19. How many milligrams of sodium are recommended as an adequate and safe level for daily intake?
    a. 200-500
    b. 2,000-3,000
    c. 3,000-6,000

20. When a label claims a food item to be "leaner"; ie. meat and poultry, it is at least
    a. 25% less fat than the standard.
    b. 45% less fat than the standard.
    c. 65% less fat than the standard.

Name: _____

Appendix E

PROGRAM CONTENT EVALUATION

The weekly sessions were provided to assist you in increasing your nutrition knowledge. Please rate the effectiveness of each session on a scale of one to five by circling the appropriate number. For example, if a session was very helpful to you, a high rating of "5" is circled; if, however, the session was not very helpful, a low rating of "1" is circled.

Nutritional Assessment	1	2	3	4	5
Method for estimating calorie needs	1	2	3	4	5
Administration of enteral feedings	1	2	3	4	5
Enteral feeding equipment	1	2	3	4	5
Fluid requirements	1	2	3	4	5
Complications of enteral feedings	1	2	3	4	5
Choosing a formula	1	2	3	4	5
Guidelines for total parenteral nutrition	1	2	3	4	5
Complications of total parenteral nutrition	1	2	3	4	5
Nutrition and your health	1	2	3	4	5

Appendix F

PROGRAM PROPOSAL

TO: Faculty Staff

FROM: Suanne Friedman, RD, CNSD
Nutrition Support Dietitian

DATE: September 22, 1989

SUBJ: Nutrition Lecture Series

Proposed Program

To give ten separate lectures to the third year medical students during their four week trauma rotation. Each lecture would require approximately thirty minutes, therefore the entire lecture series would encompass five hours of nutrition education.

Purpose

The purpose of this lecture series is to expand the nutrition education within the medical curriculum. The main focus of these lectures will be practical application of basic nutrition concepts.

Pre and post tests will be given to evaluate the impact of this lecture series for the possibility of expanding this series for the house staff, if shown to be successful.

Appendix G

PROGRAM OUTLINE: NUTRITION LECTURE SERIES

Session 1:	11/20	Introduction Questionnaire Pretest (Nutrition Support Survey) Patient interviewing survey
Session 2:	11/27	Nutritional Assessment
Session 3:	11/28	How much nutrition does my patient need?
Session 4:	11/29	Enteral nutrition: Decision process in choosing a formula
Session 5:	12/04	Enteral nutrition: Administration and equipment
Session 6:	12/05	Enteral nutrition: Complications
Session 7:	12/06	Guidelines for the use of total parenteral nutrition
Session 8:	12/11	Total parenteral nutrition Compllications
Session 9:	12/13	Fluid requirements
Session 10:	12/13	Nutrition and your health Post-test (Nutrition Support Survey) Instructors Evaluation Program Content Evaluation

Appendix H

NUTRITION LECTURE SERIES

MONDAY, TUESDAY, AND WEDNESDAY - 8:00 TO 8:30 AM

Beginning November 27-29
December 4-6
December 11-13

East Tower Trauma, Room 3016 Conference Room

Light Breakfast will be served

Instructor: Suanne Friedman, RD, CNSD
Nutrition Support Service
Beeper #188-817

Appendix I

1989
NSS Case Study Dates
for Medical Students

11/20/89 - 12/15/89

NOVEMBER 1989

27th	G.A.
	A.B.
	R.B.
28th	P.P.
	S.R.
29th	P.C.
	S.D.
30th	D.H.
	D.M.

DECEMBER 1989

4th	N.N.
	M.P.
	A.C.
5th	C.W.
	R.W.
11th	L.G.
	T.G.

Appendix J

NUTRITIONAL ASSESSMENT

An initial screen should be done within the first 72 hours of admission to identify existing or potential malnutrition. Patients who exhibit two or more nutritional risk factors as listed in Table 1 are candidates for more extensive nutritional assessment.

Table 1. Nutritional Risk Factors

1. Weight
   - a. Grossly underweight: weight <80% of usual; emaciated appearance
   - b. Grossly overweight: weight >120% of reference weight for height (tendency to overlook nutritional needs in obese, critically ill patients produces the risk in these cases)
   - c. Involuntary weight loss of ≥ 10% of usual body weight within the last 6 months
2. Laboratory values
   - a. Serum albumin <3.5 g/dL
   - b. Total lymphocyte count <1500/mm³
3. Diet (acute changes may not be observed as weight loss): significant reduction in dietary intake for 7 days or more
4. Disease/therapy/stress
   - a. Protracted nutrient losses from: Malabsorption syndromes; Short-gut syndromes; Gastrointestinal fistulae; Renal dialysis; Draining abscesses or wounds
   - b. Increased metabolic needs from: Extensive burns; Recent major surgery; Infection; Trauma; Drugs with catabolic properties
   - c. Illness lasting 3 weeks or longer
   - d. Medical conditions: Cancer and antineoplastic treatment; Gastrointestinal disease; Pressure sores; Delayed wound healing; Chewing or swallowing difficulty; Substance abuse; Preexisting malnutrition

NUTRITIONAL ASSESSMENT

Comprehensive Nutritional Assessment

Assessment Parameters

History

Must be detailed and include the following: Medical, Surgical, Social, and Nutritional Data; especially any factors that impair adequate selection, preparation, ingestion, absorption and excretion of nutrients.

- Chronic diseases affecting nutrient utilization, e.g., diabetes mellitus, pancreatitis, malabsorption, etc.
- Surgical resection of the gut or accessory organs of digestion
- Comprehensive review of usual food intake, including food allergies and aversions, use of nutritional supplements, and drug history
- Socioeconomic factors affecting food purchase or meal patterns
- History of unplanned weight changes, chewing or swallowing difficulties, nausea, vomiting, pain on eating, or changes in bowel habits

Physical Examination

Severe wasting of subcutaneous fat stores and skeletal protein can be acutely evident.

MARASMUS - Inadequate intake of both calories and protein lead to this emaciated condition

KWASHIORKOR - Edematous, pot-bellied condition results from prolonged protein inadequacy.

Table 3. Classification of Malnutrition

Type of Malnutrition	Characteristics	Nutritional Deficiency
Kwashiorkor	Rapid onset Associated with catabolic stress Body weight and anthropometric measurements are preserved Depressed visceral protein levels Impaired cellular immune response	Protein
Marasmus	Chronic weight loss Associated with relatively long inadequate dietary intake Wasted adipose and muscle tissue Visceral protein levels are preserved Relatively intact immune response	Protein and calories
Kwashiorkor-Marasmus Mix	Frequently develops when catabolic stress is superimposed on preexisting marasmus Wasted adipose and muscle tissue Depressed visceral protein levels	Protein and calories

BODY WEIGHT AND HEIGHT

Most important nutritional parameter to follow. When evaluating the patient's weight, the following must be kept in mind:

1. Hydration status - Presense of clothing, dressings, casts, amputation; Fluid balance, ie. renal failure, CHF, edema

2. Height and weight should always be measured whenever possible, as reported values are a potential source for error.

$$\% \text{ ideal body weight} = \frac{\text{actual weight}}{\text{ideal weight}} \times 100$$

$$\% \text{ usual weight} = \frac{\text{actual weight}}{\text{usual weight}} \times 100$$

$$\% \text{ weight change} = \frac{\text{usual weight} - \text{actual weight}}{\text{usual weight}} \times 100$$

Table 4 Evaluation of Weight Change*

Time	Significant Weight Loss (%)	Severe Weight Loss (%)
1 w	1-2	> 2
1 mo	5	> 5
3 mo	7.5	>7.5
6 mo	10	> 10

*Values charted are for percent weight change:

$$\text{Percent weight change} = \frac{\text{(Usual weight - Actual weight)}}{\text{(Usual weight)}} \times 100$$

NUTRITIONAL ASSESSMENT

A weight change of more than one pound per day hints at fluid shifts. One liter fluid shift can equal approximately two pounds.

When assessing weight change it is best to use the patients usual weight as tables for ideal body weight should be used only as rough guides for individuals.

FAT STORES

Fat reserves are estimated by measuring the patients triceps skinfold by calipers. In the clinical setting these measurements are often too difficult to obtain due to injuries or dressings that obscure the site and are therefore often not done.

VISCERAL PROTEIN

Several visceral proteins can be used to evaluate nutritional status since protein synthesis is affected by the patient's nutritional status.

Table 5: Methods for Assessing Visceral Protein Mass

Serum albumin.

When serum albumin (mg/dL) is	The level of visceral protein depletion is[15]
>3.5	None
2.8-3.5	Mild
2.1-2.7	Moderate
<2.1	Severe

Comment: Because the half-life of serum albumin is relatively long, about 20 days, albumin indicates initial visceral protein status but is not sensitive enough to assess early changes in nutritional status.

Serum transferrin.

Serum transferrin is measured or calculated from total iron-binding capacity (TIBC) using the equation[22]:

Calculated transferrin = (0.68 × TIBC) + 21.

When serum transferrin (mg/dL) is	The level of visceral protein depletion is[15]
>200	None
151-200	Mild
100-150	Moderate
<100	Severe

Comment: Serum transferrin has a half-life of approximately 8 days and therefore reflects acute changes in visceral protein status. The disadvantage of measuring serum transferrin is that the test is not routinely available in many clinical laboratories. Several formulas have been derived that can be used to calculate serum transferrin from TIBC, a measurement that is more readily available. However, measured transferrin is more accurate and is preferable when possible[22,23].

NUTRITIONAL ASSESSMENT

Depleted albumin and transferrin almost always accompanies significant physiologic stress, ie. infection and injury.

Low values do not necessarily reflect malnutrition, rather suggests the patient to be at risk for malnutrition. These patients have a critical need for adequate support. It is not unusual for protein levels to remain low despite aggressive nutritional support as long as significant physiologic stress persists.

IMMUNE RESPONSE

Total Lymphocyte Count - reflects the immunocompromise associated with kwashiorkor. Counts are so radically altered in the septic patient that their usefulness is questioned. Also, spontaneous fluctuation in both total WBC and differential counts from day to day make it difficult to use as a nutritional measure.

SOMATIC PROTEINS

Nitrogen Balance- is a state of equilibrium that occurs when the intake and the excretion of nitrogen are equal.

Positive balance- when more nitrogen is taken in than is excreted.

Negative balance- When more nitrogen is excreted than is taken in. Catabolic or starvation.

Nitrogen balance = Nitrogen in - Nitrogen out

$$= \frac{\text{Protein intake}}{6.25} - [(\text{UUN} \div .8) + (\text{insensible losses})]$$

Critically ill patients should be in equilibrium. Once the patient is no longer stressed, one should aim for a positive balance of 4 to 6 grams. There is no benefit to increase balance greater than this by over-feeding.

Overzealous Feeding Complications:

Excessive CO_2 production
Hyperglycemia
Pulmonary edema
Worsening of existing congestive heart failure
Possible hepatic complications

Appendix K

ENTERAL NUTRITION / THE DECISION PROCESS IN CHOOSING A FORMULA

Enteral nutrition is the provision of liquid formula by tube or mouth into the gastrointestinal (GI) tract.

The initial nutritional assessment of the patient is the key to the enteral nutrition decision making process.

1. The evaluation of the patient's ability to consume adequate nutrients by mouth.

2. **The ability to use the GI tract safely and effectively with the absence of: gastoparesis, intestinal obstruction, paralytic ileus, high output enteric fistula, initial phase of short bowel syndrome**

Advantages of using tube feedings over hyperalimentation

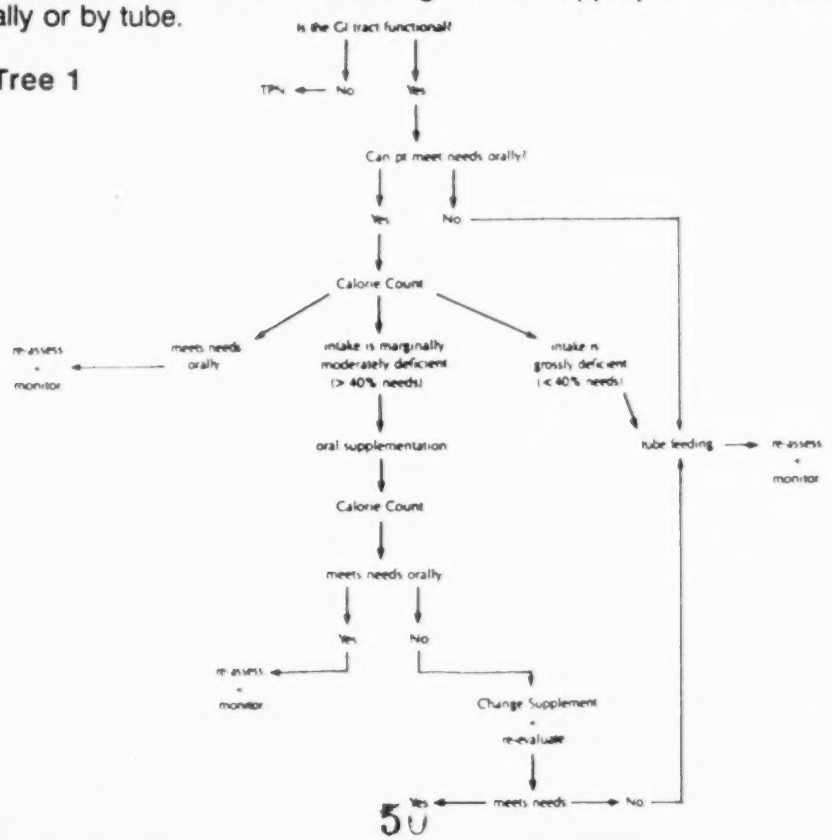
1. Reduced cost to provide same amount of nutrients

2. Reduced potential for complications

3. Increased patient safety in the maintenance of GI structural integrity, decrease atrophy.

The decision tree will assist in deciding the most appropriate method of feeding the patient; orally or by tube.

Decision Tree 1



ENTERAL NUTRITION: CHOOSING A FORMULA

Deciding on the formula

Factors that need to be considered in selecting a formula:

Table 1
Factors to Consider in Enteral Formula Selection

1. Caloric, protein, fluid needs
2. Level of metabolic stress
3. Organ failure/diet restrictions
4. Feeding site
5. Volume needed to meet RDAs
6. Lactose content
7. Osmolarity
8. Residue content
9. Anticipated length of feeding

A thorough understanding of an enteral product's nutrient characteristics is essential in the appropriate selection of formula.

This table lists the formula's composition:

Table 2
Enteral Product Categories (2)

A. Meal Replacement Formulas
(intact nutrients requiring digestion)
- 1 kcal/cc
- Blenderized
- Isoosmolar
- Lactose-free, low residue
- Milk-based

B. Nutrient Dense Formulas
(intact nutrients requiring digestion)
- 1.2–2.0 kcal/cc

C. Defined Formula Diets
(hydrolized nutrients requiring minimal to no digestion)
- 1 kcal/cc

D. Specialized Formulas
(nutrients modified for specific disease states)
- 1.0–2.0 kcal/cc

E. Modules
(carbohydrate, protein, and fat individually supplemented)

Appendix L

GUIDELINES FOR USE OF TOTAL PARENTERAL NUTRITION

Clinical setting where TPN should be a part of routine care:

1. Patients with inability to absorb nutrients by the gastro intestinal tract.

   A. Massive small bowel resection
      1. Greater than 70% small bowel resection requires an adaptation period of 2-3 years, therefore these patients require TPN until they are able to adequately absorb nutrients enterally.

      2. Patients with 70-80% resection will vary in their adaptive response depending on their age and other medical problems.

      3. 80-90% resection, the adaptive ability of the small bowel is often insufficient to allow resumption of adequate enteral nutrition. TPN will usually be required to some extent for the rest of the patients life.

   B. Disease of the small intestine: scleroderma, SLE-collagen vascular-type disease, sprue, intestinal pseudo-obstruction, multiple enterocutaneous fistulas, extensive unresectable Crohn's disease.

   C. Radiation enteritis - Treatment for cervical or bladder cancer can sometimes lead to the inability to absorb substrates from an enteral diet resulting in the need for TPN.

   D. Patients with severe diarrhea - During initial evaluation and treatment, in cases of chronic diarrhea home TPN may be necessary.

   E. Patients with intractable vomiting

2. Patients undergoing high-dose chemotherapy, radiation, bone marrow transplantation are often severely ill for 3-6 weeks, unable to eat, due to ulcerative stomatitis, nausea, vomiting, anorexia, diarrhea.

3. Moderate to severe pancreatitis - Patients who need bowel rest beyond 7 days.

4. Severe malnutrition in the face of a nonfunctional gastrointestinal tract if recovery is expected within 5-7 days in a normally nourished or mildly malnourished patient there is no need for TPN. In the severely malnourished patient tolerance to further starvation is limited therefore early TPN is warranted within 1-3 days.

5. Severely catabolic patients with or without malnutrition - Aggressive support is needed within 1-3 days especially in patients with greater than 50% TBSA burn, multiple trauma, sepsis, extensive surgery, severe inflammatory bowel disease.

Clinical Setting Where TPN Usually Would be Helpful

1. Major surgery - Patients who have had major surgery, moderate stress, enteral support not expected within 7-10 days; such as total colectomy, esophagogastrostomy, abdominal aortic aneurysm repair.

2. Moderate stress - When enteral diets cannot be resumed for over 7-10 days; such as moderate trauma, severe pancreatitis.

3. Enterocutaneous fistulas - TPN can allow for bowel rest and provide adequate nutrition prior to surgery. It can also allow for spontaneous healing in the absence of obstruction, foreign body in the fistula tract.

4. Inflammatory bowel disease - Those patients who do not respond to medical therapy may benefit from 2-4 weeks of bowel rest while receiving TPN.

5. Hyperemesis gravidarum - Severe nausea and vomiting with early pregnancy can severely decrease nutrient intake causing fetus to have developmental abnormalities. TPN needs to be considered if nausea and vomiting persists greater than 5-7 days.

6. Moderately malnourished patients who require intensive medical or surgical intervention - Patients who are moderately malnourished may be considered for 7-10 days prior to major surgery with the continuation of TPN during the stress following surgery. This will more effectively maintain nutritional status preventing further nutritional deterioration.

7. Patients receiving intensive cancer chemotherapy - Still unclear as to whether TPN enhances the effectiveness of chemotherapy. TPN can maintain a normal nutritional status during treatment, promotes a sense of well-being.

Clinical Setting Where TPN is of Limited Value

1. Minimal stress and trauma in the well-nourished patient when the GI tract is usable within a 10 day period; ie. acute pancreatitis.

2. Immediate postoperative or post-stress period - Usually anticipate the GI tract to recover within 7-10 days.

3. Proven or suspected untreatable disease states - Patients with extremely poor quality of life with no hope for improvement, ethical issues, family and patient.

Clinical Setting Where TPN Should Not be Used

1. Patients who have a functional and usable GI tract capable of absorption of adequate nutrients.

2. When the sole dependence on TPN is anticipated to be less than 5 days.

3. Patients in need of urgent operation should not have than operation delayed solely in favor of TPN.

4. Patients whose prognosis does not warrant aggressive nutritional support.

5. When the risks of TPN are judged to exceed the potential benefits.

Appendix M

HOW MUCH NUTRITION DOES MY PATIENT NEED

The most common way to estimate a patient's nutrient needs is by using the Harris-Benedict formula to determine the patient's basal energy expenditure.

Calories

The first step in planning nutritional intervention is estimation of the caloric requirement. The Harris-Benedict equation (HBE) estimates basal energy expenditure:

For Men: (66.47 + 13.75W + 5.0H - 6..76A)

For Women: (655.10 + 9.56W + 1.85H - 4.68A)

W = weight in kg
H = height in cm
A = age in years

Multiply the BEE by a factor for injury:

Table 1 Method for Estimating Total Calorie Need for Adults

Total Calorie Need = HBE x Activity Factor x Injury Factor

Activity Factor	Injury Factor*	
1.2 confined to bed 1.3 out of bed	Surgery: 1.1 minor 1.2 major Trauma: 1.35 skeletal 1.6 head injury with steroid therapy 1.35 blunt	Infection: 1.2 mild 1.4 moderate 1.8 severe Burns: 1.5 40% body surface area 1.95 100% body surface area

*The injury factor should be tapered as metabolic responses mediate.

PROTEIN

A normal diet contains 10-15% protein.

RDAs for adults - .8grams/kg/day.

During critical illness, requirements are increased to account for wound repair, replacement of protein lost in drainage or exudate.

Usually a range between 1.2 - 2 grams/kg/day is suggested, except in the case of renal failure without dialytic intervention or end stage liver disease in which case protein would need to be restricted.

NITROGEN

A calorie-to-nitrogen ration of 150:1 meets moderate to severely stressed patient needs.

Total daily nitrogen requirements = total calories ÷ 150

Total daily protein requirements = total daily nitrogen requirements multiplied by 6.25.

CARBOHYDRATES

A normal diet should contain 50%.

Caloric content-dietary carbohydrate has a value of 4 kcals/gram.

Dextrose which is the most common form of intravenous carbohydrate when in solution in the monohydrate form has a caloric value of 3.4 kcals/gram.

Oxidation of glucose is approximately 2-4 mg/kg/min. under normal conditions. In severe stress, oxidation rate increases to 3-5 mg/kg/min.

It is most important not to exceed the patient's oxidation rate as this may produce excess CO_2 impairing the process of weaning a ventilator-dependent patient.

FAT

A normal diet contains 40%. Current recommendations are to decrease to 30%.

1-2% of calories from fat need to be of linoleic acid to prevent essential fatty acid deficiency (EFAD).

Symptoms of EFAD include: growth retardation, scaly dermatitis

Prevention of EFAD for patients on hyperalimentation is to administer a minimum amount of lipids, ie. 10% 500cc or 20% 250cc two times per week.

Caloric yield of lipids - 1.1 kcal/ml for 10% emulsion; 2 kcals/ml for 20% emulsion

Contraindications for use of lipids includes hypertriglyceridemia, especially when in causes pancreatitis, and thrombocytopenia.

Appendix N

FLUID REQUIREMENTS

Fluid balance is affected by many factors:

Potential Input	Potential Losses
IV fluids/medication	urine
oral	stool
enteral	drains
parenteral	fistulas
	emesis
	respiratory/expiratory/evaporative losses

Generally, under normal conditions - estimate 1cc/kcal

Tube Feeding	% Water
Osmolite	79%
Osmolite HN	78%
Ensure	79%
Ensure Plus	71%
Vital HN	80%
Pulmocare	74%
Two Cal HN	64%
Enrich	77%
Criticare HN	83%
Isocal	84%
Isocal HCN	71%
Sustacal	84%
Sustacal HC	78%
Magnacal	69%
Fortison	85%
Reabilan	85%
Reabilan HN	80%
Compleat	71%
Isotein HN	65%
Meritene	64%

Estimating Fluid Requirements - **Problem 1**

- A patient requires 2400kcals per day
- Energy requirements are to be met by Isocal 2400 cc, (1kcal/cc)
- Determination of water requirements:
  1cc water/calorie = 2400cc water/2400kcals
- Determination of volume of water in tube feeding:
  2400cc feeding x 84% water = 2126cc water

Calculate volume of water to add:
2400cc water required - 2126cc water in tube feeding = 384cc water to be added to tube feeding regimen for adequate free water supply.

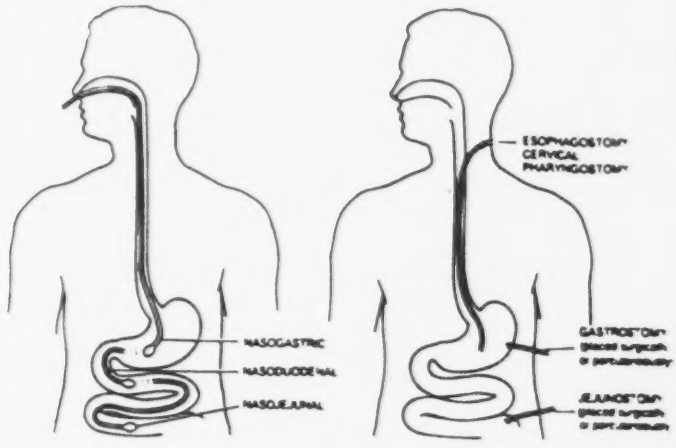
Appendix O

ENTERAL NUTRITION: ADMINISTRATION, EQUIPMENT

Feeding Sites

Tube feedings can be delivered to almost any access site in the upper gastrointestinal (GI) tract: Nasogastric (NG), nasoduodenal, nasojejunal, gastrostomy, jejunostomy, esophagostomy.

See Decision Tree 1
See Table 1 for Advantages and Disadvantages



Selection Criteria

1. Physiology of the GI tract
2. Risk of aspiration
3. Anticipated length of enteral support
4. Whether surgical placement of a feeding tube in an option.

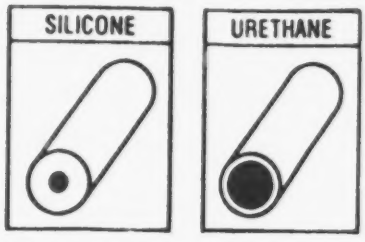
Material

1. Polyurethane - stronger, can have a thinner wall than silicone, therefore a larger internal diameter.

2. Silicone - softer, flexible, greater tendency to rupture, stretch or collapse.

   French unit measures the outer diameter of a tube. (See figure 1)

Fig. 1



Reprinted with permission from Ross Laboratories
Ross Laboratories, Columbus, Ohio

Decision Tree 1

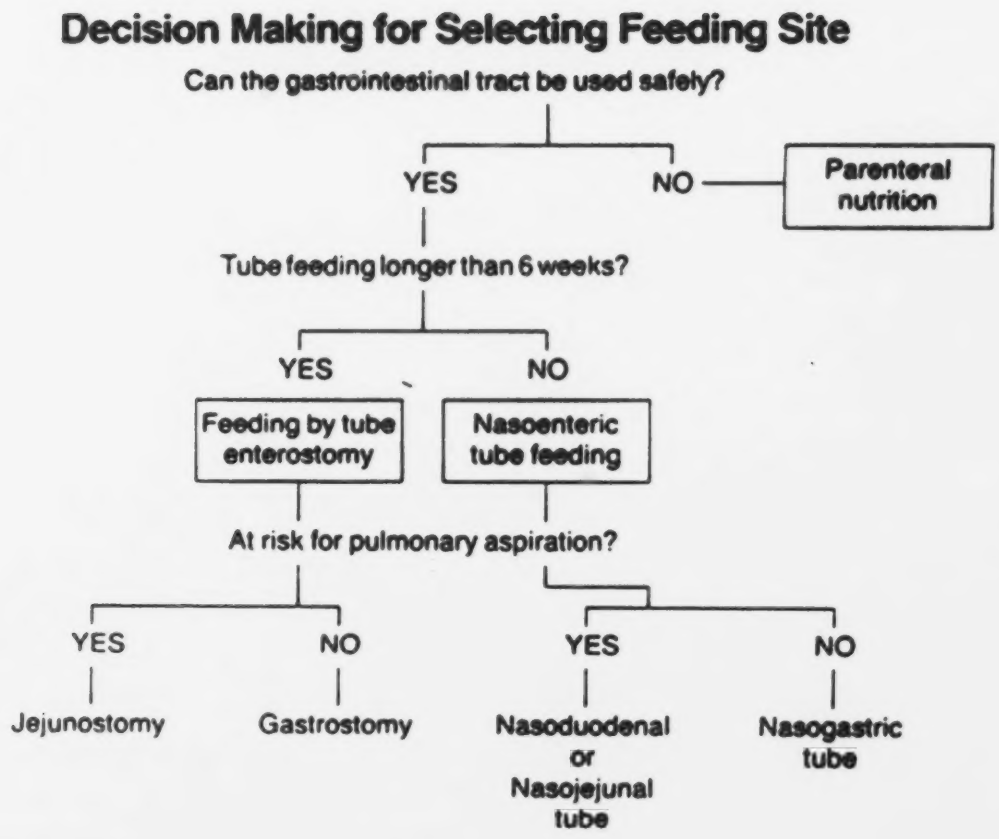


Fig 2. Steps in the decision-making process when considering enteral feeding. (Adapted from Rombeau JL, Caldwell MD (eds): *Clinical Nutrition, Vol 1: Enteral and Tube Feeding.* Philadelphia, WB Saunders Co, 1984.)

Table 1 . Enteral Tube Feeding Sites: Advantages and Disadvantages

Enteral Access	Indications	Advantages	Possible Disadvantages/ Complaints
1. Nasogastric (NG)	Requires at least a partially functional gastrointestinal tract	No surgery is required	Patient may feel self-conscious
	Useful for patients who are unable or unwilling to consume adequate nutrition by mouth due to hypermetabolism or mechanical or other factors	Nasogastric tubes are fairly easily inserted	Potential for pulmonary aspiration of gastric contents
2. Nasoduodenal or nasojejunal	Same as for NG but preferred for patient at high risk of aspiration	May reduce risk of aspiration	Transpyloric tube placement may be difficult to attain in some patients
			Potential for dumping syndrome if feed rate is not controlled
3. Gastrostomy	When the transnasal route is unavailable and/or long-term feeding is desired	Can be placed in conjunction with other surgery	Surgery required for surgical gastrostomies or jejunostomies Stoma care required
		No surgery required for percutaneous gastrostomies	Potential for inadvertent tube dislodgment
4 Jejunostomy	When enteral access in upper GI tract cannot be obtained	Can be placed in conjunction with other surgery	Surgery required for surgical gastrostomies or jejunostomies
	When there is potential for gastroesophageal reflux and pulmonary aspiration	No surgery required for percutaneous jejunostomies	Stoma care required
			Potential for intraperitoneal leakage
	When there is potential for gastroesophageal reflux and pulmonary aspiration		Potential for volvulus

Tubes greater than 16 french can cause the following problems:

- o Pressure necrosis, esophagitis, pharyngitis, otitis
- o Compromise lower esophageal sphincter competency
- o increase potential for gastric reflux and pulmonary aspiration
- o interfere with swallowing, more uncomfortable for the patient

Usually 30-36 inches in length; transpyloric placement requires 43-55 inches.

Weighted Tubes

Tubes are available with inert tungsten weights: 3gms, 5gms, 7gms, in the form of pellets, powders, segments.

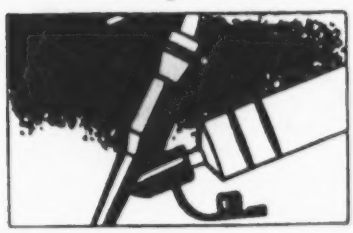
No significant difference in transpyloric passage between the three weight categories.

There is controversy as to whether weighted tubes are necessary in aiding transpyloric passage and maintaining tube placement.

Tip Design

Many tubes have multiple feeding ports or eyelets for prevention of kinking, minimizing potential for backflow and clogging. May have an additional port for irrigation or medication administration (See figure 2).

Fig. 2



Reprinted with permission from Ross Laboratories
Ross Laboratories, Columbus, Ohio

ADMINISTRATION

Factors to consider in selecting a method of administration:

1. Access site
2. Tube caliper (french size)
3. Selected formula and site
4. Gastric emptying
5. Gastrointestinal tolerance
6. Ease of administration

Two primary methods of administration:
1. Continuous
2. Intermittent (bolus)

When to use continuous administration:
1. Initiation of tube feeding;
2. When patient has not been fed for greater than 3 days;
3. When patient is critically ill;
4. When duodenal or jejunal feeding sites are used;
5. Use of a pump is preferred over gravity drip to better control the formula delivery.

When to use intermittent administration:
1. Ambulatory tube fed patients, since this gives the patient more freedom of movement;
2. Simulates meal pattern;
3. Can be administered by gravity, pump, or syringe. Syringe method not recommended as often (can be administered too quickly).
4. Ideal amount of time for each feeding should be approximately 30 minutes;
5. Volume of feeding should be no more than 250-300 cc/feeding.

Table 2

Appropriate Formulas and Delivery Methods for Enteral Feeding Based on Feeding Tube and GI Function

Tube (Caliber)	Gastrointestinal Function	Diet	Preferred Administration Schedule
Nasogastric (8-12F) →	Normal →	Intact nutrient formula →	Continuous or intermittent
	Abnormal →	Elemental formula →	Continuous
Esophagostomy/ pharyngostomy/ gastrostomy (>10F) →	Normal →	Intact nutrient formula →	Continuous or intermittent
	Abnormal →	Elemental formula →	
Surgical jejunostomy (>6F) →	Normal →	Intact nutrient formula →	Continuous controlled by enteral pump
	Abnormal →	Elemental formula	
Needle catheter jejunostomy (6F) →	Normal →	Elemental or intact nutrient formulas with ,low viscosity may be required toensure flow through 6F feeding tubes →	Continuous controlled by enteral pump
	Abnormal →		

Appendix P

COMPLICATIONS OF ENTERAL SUPPORT

Three types of complications:

1. GI disturbance - most common profuse diarrhea greater than 3 stools/day
2. Mechanical Complications - Obstruction of the tube
3. Metabolic Complications - Most common; hyperkalemia

GI Disturbance

1. Nausea
2. Vomiting
3. Diarrhea
4. Inadequate gastric emptying
5. Malabsorption

Diarrhea

Tube feedings are often to blame for diarrhea. Other factors that need to be considered:

1. Drug therapy side effects, especially antibiotics, magnesium antacids (maalox, mylanta).
2. Administration of hyperosmolar medication by bolus method.
3. Severe hypoalbuminemia, ie. less than 2.5g/dl.
4. Excessive infusion rate.
5. Contaminated products.

Guidelines for Controlling Diarrhea

1. Discontinue feeding temporarily. If the feeding is responsible, the diarrhea will generally stop in 24 hours.
2. If the patient is on antibiotics, can use lactinex, 1 packet 3 times/day to help replenish GI flora.
3. If unmanageable - may be necessary to stop enteral support and use TPN.

Mechanical Complications

1. Improper feeding tube placement
2. Tube malfunction or misuse
3. Lower esophageal sphincter incompetence
4. Gastric reflux resulting in aspiration pneumonia

Guidelines for Mechanical Complications

1. A chest x-ray should be taken to verify tube placement.
2. Frequent gastric residual checks are a major preventive measure for avoiding the complication of aspiration
3. Feeding tube placement beyond the pyloric sphincter also minimizes the possibility of aspiration.
4. Use of Reglan before feeding tube placement has also helped patients with high residuals and decreased gastric emptying rates to increase emptying time.

Metabolic Complications

Hyper- & hypo- glycemia
natremia
phosphatemia
kalemia

Hypomagnesemia
Decrease is also seen in zinc and copper levels.

Hyperglycemia - Systemic infection, diabetes
Hypoglycemia - Enteral feedings stopped with patient having received insulin
Hyponatremia - Secondary to dilutional state
Hypernatremia- Seen in neurological patients unable to conserve free water, transient diabetes insipidus ,
Hypokalemia - Seen with large doses of insulin
Hyperkalemia - Most common reported complication, possibly due to high amount of potassium in enteral formulas; associated with metabolic acidosis combined with renal insufficiency
Hypophosphatemia - Seen with treatment of insulin for hyperglycemia

Appendix Q
COMPLICATIONS OF PARENTERAL NUTRITION

Monitoring

TPN may produce a host of fluid and electrolyte abnormalities. Monitoring patients closely during the early phases of TPN administration will help identify early electrolyte abnormalities and allow for proper management (See Table 1)

Table 1 - Monitoring the patient on total parenteral nutrition

	Frequency Initial	Maintenance
Sodium, potassium, chloride, carbon dioxide, phosphorus	Daily	Every other day
Glucose	Every 4 - 6 Hours	Daily
Calcium, magnesium	Every morning	Weekly
Blood Urea nitrogen, creatinine	Every morning	Daily
Aspartate transaminase, alkaline phosphatase, bilirubin	Every other day	Weekly
Total lymphocyte count	Weekly	Weekly
Albumin, transferrin	Weekly	Weekly
Cholesterol	Weekly	Weekly

Complications (See Table 2 for a list)

1. Technical (mechanical)
2. Septic (infectious)
3. Metabolic
4. Fluid/electrolyte

Table 2

Mechanical	Infectious	Fluid/Electrolytes	Metabolic
Pneumothorax	Local Wound Infection	Hyponatremia & Hypernatremia	Hepatic steatosis
Hemothorax	Catheter sepsis	Extracellular volume overload	Acute beriberi
Hydrothorax		Hypokalemia	Protein-calorie mismatch
Hematoma		Hypophosphatemia	Hypo- & hyperglycemia
Arterial puncture		Hypomagnesemia	Hyperlipidemia
Venous thrombosis		Hypocalcemia	
		Hyperosmolality	
		Metabolic acidosis	
		Lactic acidosis	
		Ketoacidosis	
		Amino Acid Infusion	
		Respiratory acidosis	

1. Technical

This type of complication most commonly results from placement of the central venous catheter.

Pneumothorax is the most common major complication associated with catheter placement. Confirmation by chest x-ray. Treatment may require placement of a chest tube.

Air embolism is the most lethal complication.

2. Septic

Sepsis due to infection of the central venous catheter is the greatest source of morbidity. The presence of an indwelling foreign body in a central vein through which hypertonic dextrose is infused provides an ideal media for bacterial growth.

The most common bacterial pathogen is Staph. Epidermidis.

To minimize the risk:
A. Use strict aseptic technique for catheter insertion
B. Provide catheter care to CVP site as per protocol (q 48h)
C. If triple lumen catheter used, designate one port for TPN only
D. TPN must be prepared using aseptic technique in the pharmacy.

At the first sign of localized inflammation at the catheter site, the catheter should be removed and the site cultured.

If unexplained fever develops or if blood cultures are positive, without an obvious site of infection, the catheter should still be removed promptly and then treat the patient for 7 to 10 days with appropriate antibiotic therapy. Another CVP line may need to be placed at the opposite subclavian site.

3. Fluid/Electrolytes

Refeeding is associated with the following complications: Hyponatremia (increase in the level of total body water), hypokalemia, hypophosphatemia, hypomagnesemia, hypocalcemia.

When the body shifts from a catabolic state to an anabolic state, the following results: Hypokalemia, hypophosphatemia, hypomagnesemia.

These electrolytes are being incorporated into newly synthesized muscle tissue. Also, with the infusion of a hypertonic glucose and insulin, there is a shift of potassium and phosphorus from the extracellular to the intracellular space.

4. Metabolic Complications

Hepatic steatosis - acute fatty infiltrates of the liver. This is an occasional complication of glucose-predominant TPN regimen. Excess glucose is converted to fat in the liver where it is then deposited. Patients will exhibit cholestatic jaundice, increased alkaline phosphatase and increased bilirubin levels.

Lipid-glucose formulations are rarely complicated by hepatic steatosis.

TPN and Respiratory Function

Amino acid infusion increases ventilatory responsiveness to carbon dioxide.

High-glucose infusion is associated with an increased respiratory quotient, carbon dioxide production, and oxygen consumption.

This type of TPN regimen may be associated with worsening of respiratory failure from increased carbon dioxide production.

Recommended TPN regimen is one that incorporated a large fraction of lipids as energy substrate.

Lipid has a lower respiratory quotient than glucose, therefore it is associated with less carbon dioxide production.

SUMMARY

TPN regimens must reflect the patients:
1. Underlying disease
2. Protein and energy requirements
3. Degree of hypermetabolism
4. Presence of any fluid or electrolyte abnormalities

Appendix R
NUTRITION AND YOUR HEALTH

Cutting Excess Calories - What's Best for You?

What's the best way to change "what" and "how much" you eat? It depends on your eating habits. If rich desserts are a problem, you can opt for no dessert, a very small portion, or fresh fruit instead.

If topping on your baked potato is a source of extra calories, what's best for you - no topping, less topping, or plain yogurt instead of sour cream?

If you're used to the flavor of whole milk but want less fat and fewer calories, what's best for you - directly switching from whole milk to skim milk or trying lowfat milk first?

You can see that it's up to you. The important thing is to make some changes that will make a difference over the long run.

What is sodium?

Sodium is a mineral that occurs naturally in some foods and is added to many foods and beverages. Most of the sodium in the American diet comes from table salt, which is 40 percent sodium and 60% chloride. One teaspoon of salt contains about 2,000 milligrams of sodium.

Why is sodium important?

Sodium attracts water into the blood vessels and helps maintain normal blood volume and blood pressure. Sodium is also needed for the normal function of nerves and muscles.

How much sodium do I need?

Although some sodium is essential to your health, you need very little. The National Research Council of the National Academy of Sciences suggests that a "safe and adequate" range of sodium intake per day is about 1,100 to 3,300 milligrams for adults. This is well below the amount that most American adults consume.

Where is sodium found in my diet?

Sodium is in many foods you eat. It may occur naturally in a food or be added during processing, cooking, or at the table. Most sodium added during processing comes from salt, but other ingredients and additives used by manufacturers contain sodium as well.

Salt is second only to sugar in amount added by manufacturers to the foods Americans eat.

Foods that provide significant amounts of sodium in the diets of Americans (excluding sodium added during cooking or at the table) include bread and bakery products, cured and processed meats, canned vegetables, and milk products, especially many cheeses. Estimating the actual sodium content of diets is difficult because of the variable amounts of sodium people add to foods during cooking and at the table.

What's that sodium DOING there?

Most of the sodium in processed foods is added to preserve and/or flavor them. Salt is the major source of sodium added to these foods. It is added to most canned and some frozen vegetables, smoked and cured meats, pickles, and sauerkraut. Salt is used in most cheeses, sauces, soups, salad dressings, and in many breakfast cereals. Sodium is also found in many other ingredients used in food processing. Examples of sodium-containing ingredients and their uses in foods are:

Baking powder - leavening agent
Baking soda - leavening agent
Monosodium glutamate - flavor enhancer
Sodium benzoate - preservative
Sodium caseinate - thickener and binder
Sodium citrate - buffer, used to control acidity in soft drinks and fruit drinks
Sodium nitrate - curing agent in meat, provides color, prevents botulism
Sodium phosphate - emulsifier, stabilizer, buffer
Sodium saccharin - artificial sweetener

About condiments -

Watch out for commercially prepared condiments, sauces, and seasonings when preparing and service foods for you and your family. Many, like the following, are high in sodium: Onion salt, Celery salt, Garlic salt, Seasoned salt, Meat tenderizer, Bouillon, Baking powder, Baking soda, Monosodium glutamate, Soy sauce, Steak sauce, Barbecue sauce, Catsup, Mustard, Worcestershire sauce, Salad dressings, Pickles, Chili sauce, Relish.

Salt-Sodium Conversions
1/4 tsp. salt = 500 mg. sodium
1/2 tsp. salt = 1,000 mg. sodium
3/4 tsp. salt = 1,500 mg. sodium
1 tsp. salt = 2,000 mg. sodium

Low calorie
Contains no more than 40 calories per serving or no more than 0.4 calories per gram.

Reduced Calorie
Has one-third fewer calories than the original product and must include a comparison of the original product and the reduced calorie version.

Diet or Dietetic
May be reduced in either calories, sodium or sugar.

Light or Lite
Can mean anything. Terms may refer to texture, color, or taste, or to reduced calorie, sodium, or fat content.

No Cholesterol
Contains no cholesterol, but may contain saturated fats.

Low-Fat (dairy products)
Contains between 0.45 and 2 percent fat by weight.

Extra Lean (meat and poultry)
Has no more than 5 percent fat by weight.

Lean (meat and poultry)
Contains no more than 10 percent fat by weight

Leaner (meat and poultry)
Has at least 25 percent less fat than the standard

Sugar Free or Sugarless
Contains no table sugar, but may contain one of the following, which have the same amount of calories as sugar: honey, fructose, corn syrup, or sorbitol. Products may also be high in fat and calories.

Sodium free
Contains less than 5 mg sodium per serving.

Very low sodium
Has 35 mg or less per serving

Low sodium
Contains 140 mg or less per serving

Reduced sodium
The usual level of sodium in a product has been reduced by at least 75 percent

Unsalted, No salt added, or Without added salt
No salt has been added in processing, but the food may still contain other sodium-containing ingredients.

15 Tips to Help You Avoid Too Much Fat, Saturated Fat, and Cholesterol

1. Steam, boil, or bake vegetables; or for a change, stirfry in a small amount of vegetable oil.
2. Season vegetables with herbs and spices rather than with sauces, butter, or margarine.
3. Try lemon juice on salads or use limited amounts of oil-based salad dressing.
4. To reduce saturated fat, use margarine instead of butter in baked products and, when possible, use oil instead of shortening.
5. Try whole-grain flours to enhance flavors of baked goods made with less fat and cholesterol-containing ingredients.
6. Replace whole milk with skim or lowfat milk in puddings, soups, and baked products.
7. Substitute plain lowfat yogurt, blender-whipped lowfat cottage cheese, or buttermilk in recipes that call for sour cream or mayonnaise.
8. Choose lean cuts of meat.
9. Trim fat from meat before and/or after cooking.
10. Roast, bake, broil, or simmer meat, poultry, or fish.
11. Remove skin from poultry before cooking.
12. Cook meat or poultry on a rack so the fat will drain off. Use a nonstick pan for cooking so added fat will be unnecessary.
13. Chill meat or poultry broth until the fat becomes solid. Spoon off the fat before using the broth.
14. Limit egg yolks to one per serving when making scrambled eggs. Use additional egg whites for larger servings.
15. Try substituting egg whites in recipes calling for whole eggs.

Fat and Cholesterol - What are They? Where are They Found?

FAT is the most concentrated source of food energy (calories). Each gram of fat supplies about 9 calories, compared with about 4 calories per gram of protein or carbohydrate and 7 calories per gram of alcohol. In addition to providing energy, fat aids in the absorption of certain vitamins. Some fats provide linoleic acid, an essential fatty acid which is needed by everyone in small amounts.

Butter, margarine, shortening, and oil are obvious sources of fat. Well-marbled meats, poultry skin, whole milk, cheese, ice cream, nuts, seeds, salad dressings, and some baked products also provide a lot of fat.

CHOLESTEROL is a fat-like substance found in the body cells of humans and animals. Cholesterol is needed to form hormones, cell membranes, and other body substances. The body is able to make the cholesterol it needs for these functions. Cholesterol is not needed in the diet.

Cholesterol is present in all animal tissues - meat, poultry, and fish - in milk and milk products, and in egg yolks. Both the lean and fat of meat and skin of poultry contain cholesterol. Cholesterol is not found in foods of plant origin such as fruits, vegetables, grains, nuts, seeds, and dry beans and peas.

FATTY ACIDS are the basic chemical units in fat. They may be either "saturated," "monounsaturated," or "polyunsaturated." All dietary fats are made up of mixtures of these fatty acid types.

Saturated fatty acids are found in largest proportions in fats of animal origin. These include the fats in whole milk, cream, cheese, butter, meat, and poultry. Saturated fatty acids are also found in large amounts in some vegetable oils, including coconut and palm.

Monounsaturated fatty acids are found in fats of both plant and animal origin. Olive oil and peanut oil are the most common examples of fat with mostly monounsaturated fatty acids. Also, most margarines and hydrogenated vegetable shortenings tend to be high in monounsaturated fatty acids.

Polyunsaturated fatty acids are found in largest proportions in fats of plant origin. Sunflower, corn, soybean, cottonseed, and safflower oils are vegetable fats that usually contain a high proportion of polyunsaturated fatty acids. Some fish are also sources of polyunsaturated fatty acids.

NOTE: All fats, whether they contain mainly saturated fatty acids, monounsaturated fatty acids, or polyunsaturated fatty acids, provide the same number of calories.

Appendix S

INSTRUCTORS EVALUATION

Please rate the instructor's performance on a scale of one to five by circling the appropriate number. A rating of "5" is high or effective and a rating of "1" is poor or minimally effective.

Knowledge of subject matter	1	2	3	4	5
Interest and enthusiasm	1	2	3	4	5
Confidentiality	1	2	3	4	5
Managed class time effectively	1	2	3	4	5
Information presented clearly and in an organized manner	1	2	3	4	5
Handouts effective and easily read	1	2	3	4	5
Stimulated thought and discussion	1	2	3	4	5
Learning activities related to subject matter	1	2	3	4	5

Would you take another class taught by this instructor? _____ yes _____ no

END

U.S. Dept. of Education

Office of Education
Research and
Improvement (OERI)

ERIC

Date Filmed

March 29, 1991